APPLICATIONS OF NANOTECHNOLOGY IN WATER AND WASTE WATER TREATMENT

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Abstract:

Providing clean and affordable water to meet human needs is a grand challenge of the 21st century. And because of that Water Reuse as an industry has been around for many years but the core technology and process hasn't changed significantly. Nanotechnology offers opportunities to develop next generation water supply systems in this research, the application of various nonmaterial's such as metal nanoparticles, metal oxides, carbon compounds, zeolite, filtration membranes, etc., in the field of wastewater treatment is discussed. Here it gives the review on recent development in nanotechnology for water and wastewater treatment.

Keywords: Nanotechnology, Nanomaterials, Water reuse,nano particles, metal oxides, carbon compounds, zeolite, filtration membranes.

Introduction:

Only 30% of all freshwater on the planet is not locked up in ice. Of that, some 20% is in areas too remote for humans to access and of the remaining 80% about three-quarters comes at the wrong time and place - in monsoons and floods - and is not always captured for use by people. The reminder is less than 0.08 of 1% of the total water on the planet [3].

Nanotechnology-enabled water and wastewater treatment promises to not only overcome major challenges faced by existing treatment technologies but also to provide new treatment capabilities that could allow economic utilization of unconventional water sources to expand the water supply. Nanomaterials were suggested as efficient cost-effective and environmental friendly alternative to existing treatment materials, from the standpoints of both resource conservation and environmental remediation.

The significance of the wastewater treatment, management, and its disposal is gradually increasing in the modern times and it has become a major concern for public health scientific interest. Nanotechnology holds great potential in advancing water and wastewater treatment to improve treatment efficiency as well as augment water supply through safe use of

unconventional water sources. The tools and methods for nanotechnology involve imaging, measuring, modelling, and manipulating matter at the nanoscale.

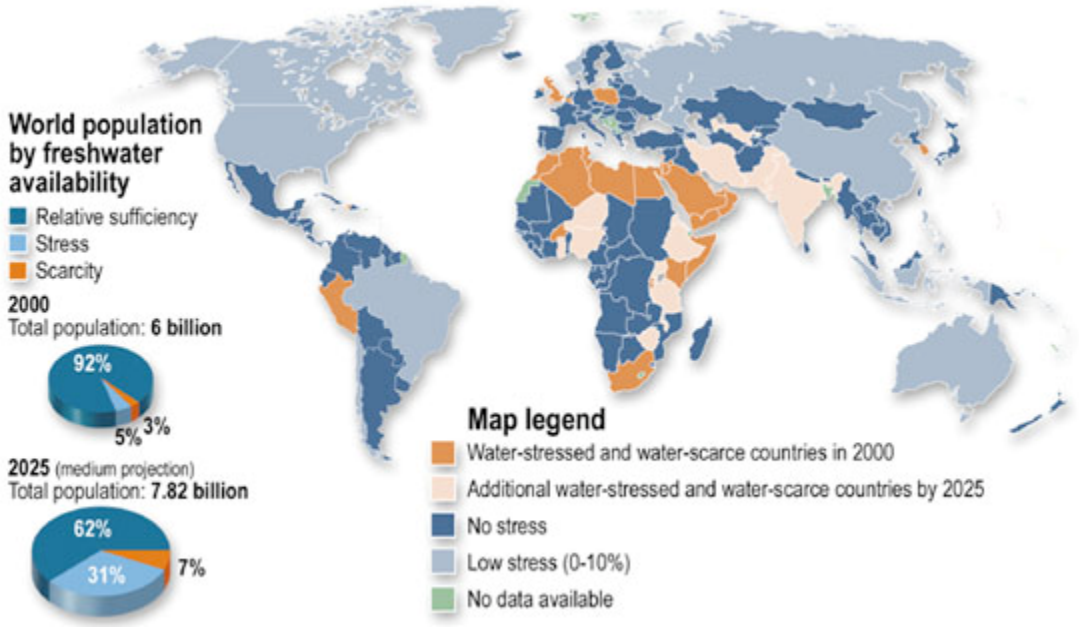


Fig 1: World Population by freshwater availability

Advantages of nanotechnology in water and wastewater Treatment:

1. Preliminary treatment: This includes removing coarse and readily settleable inorganic solids with the size range of more than 0.01 mm.

2. Primary treatment: This removes the bulk of suspended solids including both organic and inorganic matter (0.1 mm to 35 μm).

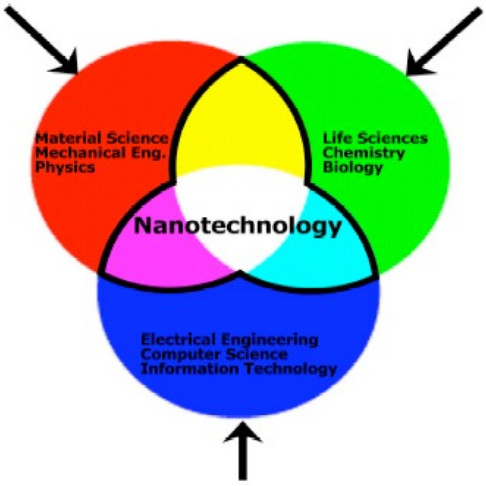
3. Secondary biological treatment degrades the biodegradable binding organic matter and nutrients.

4. Tertiary treatment removes a portion of the remaining organic and inorganic solids and pathogenic microorganisms through a filtration step. This treatment is followed by Chemical disinfection[1]

Sustainability and New Technology:

Now a day's technology develops existing process and implements novel potable water and waste water treatment processes with low cost, low energy, low environmental impact and low footprint membrane processes Effective removal of micro contaminants and nitrates/phosphates from waste water.

The National Science Foundation (a major distributor for nanotechnology research in the United States) funded researcher David Berube to study the field of nanotechnology. As nanotechnology is a truly multi-disciplinary field, the cooperation between researchers in all related areas is crucial to the success of nanotechnology. Until now, computer science has taken a role mostly in research tools, for example: a virtual reality system coupled to scanning probe devices in nano manipulator project. However, according to M. C. Roco, the third and fourth generation of nanotechnology would rely heavily on research in computer science.[4]



Nanotech is the nexus of the sciences [6]

Recent advances show that many of the current problems with water quality can be addressed using nanosorbents, nanocatalysts, bioactive nanoparticles, nanostructured catalytic membranes, and nanoparticle enhanced filtration.

Current and Potential application for water and waste water Treatment:

Nanotechnology for water remediation will play a crucial role in water security and consequently the food security of the world. The applications of nanotechnology in the cleanup of contaminated water could be summarized by (Smith 2006):

• Nanoscale filtration techniques
• The adsorption of pollutants on nanoparticles
• The breakdown of contaminants by nanoparticle catalysts.

Nanomaterials are typically defined as materials smaller than 100 nm in at least one dimension. At this scale, materials often possess novel size-dependent properties different from their large counterparts which might already be explored for the water treatment purposes. These properties may relate to the high specific surface area, such as fast dissolution, high reactivity, and strong Sorption, or to their discontinuous properties, such as super paramagnetism,localized surface plasmon resonance, and quantum confinement effect. Most applications are still in the stage of laboratory research.

a. Absorption: Adsorption is commonly used to remove organic and inorganic contaminants in water and wastewater treatment. Nanosorbents provide significant improvement over conventional adsorbernts with their extremely high specific surface area and associated sorption sites, short intraparticle diffusion distance, and tunable pore size and surface chemistry.

    -Organic removal

    -Heavy metal removal

    -Regeneration and reuse

b. Metal based nano absorbents : It includes fast absorption of metal ions on the external surface followed by diffusion along micro-pore walls.

Nanotechnology is helping to considerably improve, even revolutionize, many technology and industry sectors: information technology, energy, environmental science, medicine, homeland security, food safety, and transportation, among many others. Nanoscale transistors that are faster, more powerful, and increasingly energyefficient; soon computer's entire memory may be stored on a single tiny chip. Magnetic random access memory (MRAM) enabled by nanometer scale magnetic tunnel junctions that can quickly and effectively save even encrypted data during a system shutdown or crash, enable resume play features, and gather vehicle accident data. Other computing and electronic products include Flash memory chips for iPod nanos; ultra responsive hearing aids; antimicrobial/antibacterial coatings on

Mouse/keyboard/cell phone casings

For the purpose of improving the listed treatment processes, the use of nanomaterials is being researched to fabricate separation and reactive media which is of high quality in terms of reactivity and performance [7].

Conclusion:

As the development of nanotechnology progresses in several fields including physics, chemistry, biology and material science, computer scientists, medical, military must be aware of their roles and brace themselves for the greater advancement of nanotechnology in the future. This article is intended to promote collaboration between computer science and nanotechnologies to water and waste water management.

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